

# Comparative study of Amazon EC2 and Microsoft Azure cloud architecture

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## ABSTRACT

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Cloud computing refers to a network that distributes processing power, applications, and large systems among many computers. In current era, all companies are going for computerization. It is not feasible for every startups to invest high amount of money for purchasing servers and recruiting IT staff who can handle these servers. Instead of this, better option is use of cloud computing, where companies just required to take services from cloud computing providers as per requirement. Lots of option are available while choosing Cloud service provider. Amazon EC2 and Microsoft Azure are example of such Cloud Service Provider. In this paper, researchers have given brief details of Amazon EC2 and Microsoft Azure Cloud. It is very difficult to decide one cloud service provider from all. In this paper, comparison of Amazon EC2 and Microsoft Azure is given, which will help in taking decision for choosing Cloud Provider.

Keywords - Cloud Computing, Amazon EC2, Microsoft Azure, Selection of cloud provider

## I. INTRODUCTION

Cloud computing' is now not a new concept in the computing world, although the idea has existed for a longer time. A few years after the dot-com bubble burst in 1999, companies like Amazon who had invested hugely in computing infrastructure, started leasing out their underutilized and unused hardware with cloud computing technology, resulting in cloud computing gaining attention and popularity within the computing industry. Cloud computing has started to be an option in recent years for several reasons. The "web 2.0" shift can be named as an example, as providers are shifting their services from local infrastructure to external services using various web services. A few years ago a web company would have needed to host and maintain its own billing system and payment gateway, making long-term and expensive contracts with credit card companies, banks, security companies, etc. With the emergence of companies like PayPal, BillDesk and ccavenue, any individual can now accept credit cards without a contract or long-term commitment and use the services on a pay-as-you-go basis. As the Internet has become a part of almost any household and is viewed as a commodity everyone has access to, companies can move their software services more securely to the internet, and by that make cloud computing platforms a possible choice. The economy of scale is greatly in favor of cloud computing. Cloud users can take computing power as and when required from any cloud providers without investing much in Infrastructure and

cloud providers can cut their prices by investing in huge data centers and potentially save money of each other.

The concept "utility computing", which cloud computing is in many ways based on, has been the vision of computer scientists for decades [1].

In the 1960s, the American computer scientist John McCarthy stated that "If computers of the kind I have advocated become the computers of the future, then computing may someday be organized as a public utility just as the telephone system is a public utility... The computer utility could become the basis of a new and important industry" [2]

Cloud Computing definition from the National Institute of Standards and Technology (NIST) [2]:

"Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models."

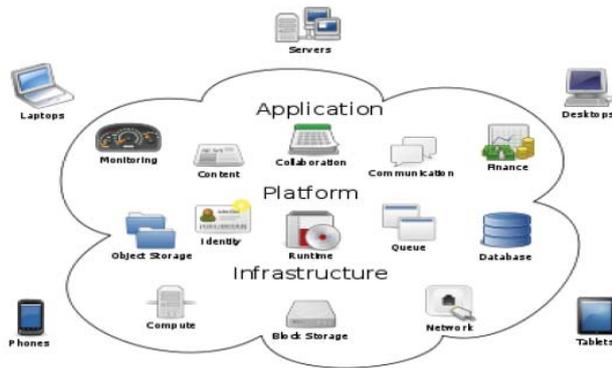


Figure 1 : Cloud Computing (Source : Wikipedia)

### VIII. CLOUD COMPUTING OVERVIEW

The actual term "cloud" borrows from telephony in that telecommunications companies, who until the 1990s primarily offered dedicated point-to-point data circuits, began offering Virtual Private Network (VPN) services with comparable quality of service but at a much lower cost. By switching traffic to balance utilization as they saw fit they were able to utilize their overall network bandwidth more effectively. The cloud symbol was used to denote the demarcation point between that which was the responsibility of the provider from that of the user. Cloud computing extends this boundary to cover servers as well as the network infrastructure.

Cloud computing is having various key features like.

1. Reduce capital expenditure.
2. Device and location independence.
3. Peak-load capacity increases.
4. Reliability is improved.
5. Scalability.
6. Security.
7. Ease of Maintenance.

Cloud computing can be deployed in various models.

1. Public cloud
2. Private cloud
3. Hybrid Cloud
4. Community Cloud

Along with these, some articles contains one more development model that is.  
Commodity Cloud.

Cloud Service Models.

- 1) Software as a Service (SaaS)

Software as a service is a software distribution model in which applications are hosted by a vendor or service provider in cloud and made available to customers over a network, typically the Internet.

- 2) Platform as a Service (PaaS)

Platform as a Service (PaaS) is a way to rent hardware, operating systems, storage and network capacity over the Internet. The service delivery model allows the customer to rent virtualized servers and associated services for running existing applications or developing and testing new ones.

- 3) Infrastructure as a service (IaaS).

Infrastructure as a Service is a provision model in which an organization outsources the equipment used to support operations, including storage, hardware, servers and networking components. The service provider owns the equipment and is responsible for housing, running and maintaining it. The client typically pays on a per-use basis.

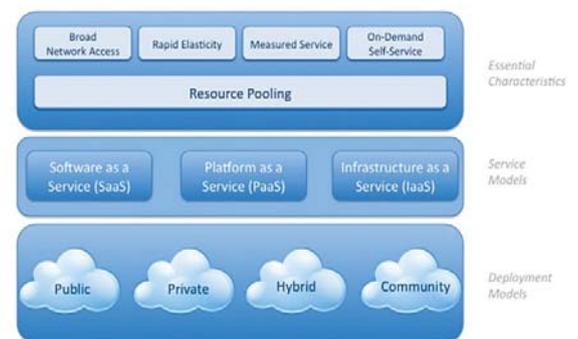


Figure 2 : Cloud Service Models (Source : <http://skmahdesia87.blogspot.in/2012/08/article-cloud-computing-and-its.html>)

Cloud Computing Providers

There are many cloud computing providers available in industry. Few companies are leading in this is listed below.

- Amazon Elastic Compute Cloud (EC2)
- Microsoft Azure Services Platform
- Google App Engine
- Salesforce.com
- Akamai EdgePlatform
- IBM Computing on Demand (CoD)
- Rackspace Cloud
- Terremark
- NetSuite

And many more

In this paper we are studying and comparing Amazon Elastic Compute Cloud (EC2) and Microsoft Azure.

## II. UNDERSTANDING AMAZON ELASTIC COMPUTE CLOUD

Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides resizable compute capacity in the cloud. It is designed to make web-scale computing easier for developers. Amazon EC2's simple web service interface allows you to obtain and configure capacity with minimal friction. It provides you with complete control of your computing resources and lets you run on Amazon's proven computing environment. Amazon EC2 reduces the time required to obtain and boot new server instances to minutes, allowing you to quickly scale capacity, both up and down, as your computing requirements change. Amazon EC2 changes the economics of computing by allowing you to pay only for capacity that you actually use. Amazon EC2 provides developers the tools to build failure resilient applications and isolate themselves from common failure scenarios [8].

### Components of Amazon EC2:



Figure 3 : Components of Amazon EC2

(Source:<http://www.oracleappshub.com/emerging-technologies/understanding-amazon-web-services-aws>)

Figure 3 shows all components of Amazon Elastic Compute Cloud.

### 1) Elastic Compute Units:

The Elastic Compute Unit (ECU) was introduced by Amazon EC2 as an abstraction of computer resources. Amazon's Definition of ECU notes "We use several benchmarks and tests to manage the consistency and predictability of the performance of an EC2 Compute Unit. One EC2 Compute Unit provides the equivalent CPU capacity of a 1.0-1.2 GHz 2007 Opteron or 2007 Xeon processor.

### 2) Amazon EC2 Instances Types

Amazon EC2 instances types are grouped into six families [10]:

- Standard
- Micro
- High-Memory
- High CPU
- Cluster Compute
- Cluster GPU

### 3) EC2 Storage Types

- Elastic Block Storage (EBS): This is persistent, network-based storage called Elastic Block Store(EBS), which can be attached to running instances or also used as a persistent boot medium.
- Instance Storage: This is local storage, which is non-persistent and data will be lost after an instance terminates [10].

### 4) Elastic IP Addresses

Amazon's Elastic IP Address feature is similar to static IP address in traditional data centers, with one key difference. A user can programmatically map an Elastic IP Address to any virtual machine instance without a network administrator's help and without having to wait for DNS to propagate the new binding. In this sense an Elastic IP Address belongs to the account and not to a virtual machine instance. It exists until it is explicitly removed. It remains associated with the account, even while it is associated with no instance.

### 5) Amazon CloudWatch

Amazon CloudWatch is a web service that provides monitoring for AWS cloud resources and applications, starting with Amazon EC2. It provides you with visibility into resource utilization, operational performance, and overall demand patterns—including metrics such as CPU utilization, disk reads and writes, and network traffic. You can get statistics, view graphs, and set alarms for your metric data. To use Amazon CloudWatch, simply select the Amazon EC2 instances that you'd like to monitor. You can also supply your own business or application metric data. Amazon CloudWatch will begin aggregating and storing monitoring data that can be accessed using web service APIs or Command Line Tools [11].

### 6) Automated Scaling

Auto Scaling allows you to automatically scale your Amazon EC2 capacity up or down according to conditions you define. With Auto Scaling, you can ensure that the number of Amazon EC2 instances you're using scales up seamlessly during demand spikes to maintain performance, and scales down automatically during demand lulls to minimize costs.

Auto Scaling is particularly well suited for applications that experience hourly, daily, or weekly variability in usage. Auto Scaling is enabled by Amazon CloudWatch and available at no additional charge beyond Amazon CloudWatch fees [11].

### III. UNDERSTANDING WINDOWS AZURE

Windows Azure is Microsoft's application platform for the public cloud. Your applications can use this platform in many different ways. For instance, you can use Windows Azure to build a web application that runs and stores its data in Microsoft datacenters. You can use Windows Azure only to store data, with the applications that use that data running on-premises (that is, outside the public cloud). You can use Windows Azure to help on-premises applications connect with each other or to map between different sets of identity information or in other ways. Because the platform offers a wide range of services, all of these things—and more—are possible [12]

#### A. COMPONENTS OF WINDOWS AZURE

To understand what Windows Azure offers, it's useful to group its services into distinct categories and you need to know what its components do. Figure 4 shows one way to do this

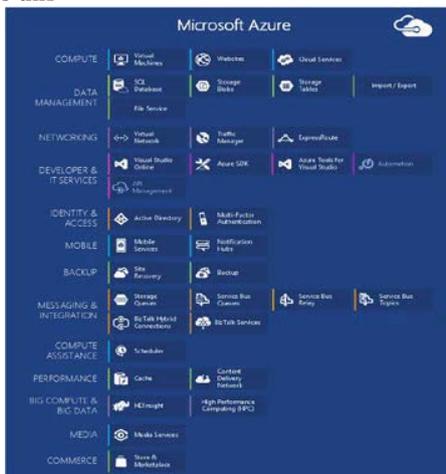


Figure 4 : Components of Windows Azure (Source : <http://azure.microsoft.com/en-us/documentation/articles/fundamentals-introduction-to-azure/>)

### 1) Cloud Applications

Windows Azure provides two types of roles [12]:

- **Web roles:** A web role is designed for code that talks directly with web browsers or other HTTP clients i.e. it depends on IIS, Microsoft's web server. For example, ASP.NET or PHP application.
- **Worker roles:** A worker role is more general, designed to run a variety or different type of code. For example, application that processes lots of data in parallel.

Each role instance is really just a virtual machine (VM) running a flavor of Windows Server and each one executes in a Windows Azure datacenter (see Figure 4) [12]

Load Balancing on a Windows Azure application:

- If the load increases, maybe you've acquired a large number of new users all at once.
- If the load decreases, another request can shrink the number of instances. And because Windows Azure charges you by the hour for each instance, you pay only for the capacity you need.

### 2) Data Management

Every Windows Azure application runs in one or more VMs. Each VM has local storage, which an application is free to use.

Windows Azure provides five data management options (see Figure 4)

- SQL Azure
- Tables
- Windows Azure Blobs Storage Service
- Import / Export
- Azure File Service

### 3) Networking :

Azure runs today in many datacenters spread across the world. When you run an application or store data, you can select one or more of these datacenters to use. You can also connect to these datacenters in various ways using the services below.

- Virtual Network
- Traffic Manager
- Express Route

### 4) Identity and Access Control :

Working with identity is part of most applications. Knowing who a user is lets an application decide how it should interact with that user. Azure provides services to help track identity as well as integrate it with identity stores you may already be using.

- Active Directory
- Multi Factor Authentication

5) Messaging and Integration

No matter what it's doing, code frequently needs to interact with other code. In some situations, all that's needed is basic queued messaging. In other cases, more complex interactions are required. Azure provides a few different ways to solve these problems. Figure 4 illustrates the choices.

- Storage Queue
- Service Bus Queue
- Service Bus Relay
- Service Bus Topics
- Biz Talk Hybrid Connection
- Biz Talk Service

IV. COMPARISON BETWEEN MICROSOFT AZURE VS AMAZON EC2

IX.

As many companies have large amounts of information stored on computers, the need for memory is essential. Cloud computing removes the need to install dedicated software to the computer, thereby reducing the amount of memory needed. . Azure and EC2 conceptually do the same thing. Both EC2 and Microsoft Azure cloud computing technologies allow the expansion of the virtual machines or VMs used for applications – both in number and power. Both services work on the basis of the Virtual Machine model. Amazon EC2 and Azure are both marketers of applications through independent software vendors(ISV)[15].

We will compare Microsoft Azure and Amazon EC2 with few parameters.

1) General comparison of Amazon EC2 and Microsoft Azure[15].

Feature	Amazon EC2	Microsoft Azure
Types of Cloud Computing Provided.	Amazon provides all three types of cloud computing ie SasS, PasS and IasS, but major player in IaaS.	Microsoft Azure provides all three types of cloud computing ie SasS, PasS and IasS, but major player in PaaS.
Relationa	SQL, MySQL and	SQL Azure –

I Database Support	Oracle	Relational Database for Azure in SQL Server
Virtualization Technology	XEN Virtualization Technology	Hyper V – Hypervisor based virtualization Technology
IDE Support	SDK is available for Eclipse	SDK is available for Eclipse and visual studio.

Table 1 : General Comparison of EC2 and Azure

2) Price comparison

Feature	Amazon EC2	Microsoft Azure
Base Plan Price	\$0.11/hour	\$0.02 / hour
Virtual CPU Core	1 VCPU's	-
RAM	3,840MB	768MB
Disk Space	4 GB	20 GB
Subscription Option	<ul style="list-style-type: none"> <li>• Hourly Rate</li> <li>• Monthly / Fixed Rate</li> <li>• Reserved Instances</li> <li>• Spot Instances</li> </ul>	<ul style="list-style-type: none"> <li>• Hourly Rate</li> </ul>

Table 2 : Price Comparison

3) Administration and Support

Feature	Amazon EC2	Microsoft Azure
Administration & Compliance Details	<ul style="list-style-type: none"> <li>• Access Management</li> <li>• Compliance Monitoring</li> <li>• Detailed Invoices</li> </ul>	<ul style="list-style-type: none"> <li>• FedRAMP</li> <li>• HIPAA Compliant</li> <li>• ISO 27001 Certified</li> <li>• Network</li> </ul>

		Uptime Guarantee <ul style="list-style-type: none"> <li>• PCI Compliant</li> <li>• SOC 2</li> <li>• SSAE16 Audited Facility</li> </ul>
Support Services Available	<ul style="list-style-type: none"> <li>• 24/7</li> <li>• Forums</li> <li>• Online/Self-Serve Resources</li> </ul>	<ul style="list-style-type: none"> <li>• 24/7</li> <li>• Forums</li> <li>• Live Chat</li> <li>• Phone</li> </ul>

Table 3 : Administration and Support service comparison.

4) Specification

Feature	Amazon EC2	Microsoft Azure
Server OS Types	<ul style="list-style-type: none"> <li>• Linux</li> <li>• Windows</li> </ul>	<ul style="list-style-type: none"> <li>• Linux</li> <li>• Windows</li> </ul>
Preconfigured Operating Systems	<ul style="list-style-type: none"> <li>• Amazon Linux</li> <li>• Cent OS</li> <li>• Debian</li> <li>• Oracle Enterprise Linux</li> <li>• Red Hat Enterprise Linux</li> <li>• SUSE Enterprise Linux</li> <li>• Ubuntu</li> <li>• Windows Server</li> </ul>	<ul style="list-style-type: none"> <li>• Cent OS</li> <li>• FreeBSD</li> <li>• openSUSE Linux</li> <li>• Oracle Enterprise Linux</li> <li>• SUSE Enterprise Linux</li> <li>• Ubuntu</li> <li>• Windows Server</li> </ul>
Available Runtimes	<ul style="list-style-type: none"> <li>• .NET</li> </ul>	<ul style="list-style-type: none"> <li>• .NET</li> </ul>

	<ul style="list-style-type: none"> <li>• Java</li> <li>• PHP</li> <li>• Python</li> <li>• Ruby</li> </ul>	<ul style="list-style-type: none"> <li>• Java</li> <li>• Node</li> <li>• PHP</li> <li>• Python</li> <li>• Ruby</li> </ul>
Middleware	<ul style="list-style-type: none"> <li>• Tomcat</li> </ul>	----
Frameworks	<ul style="list-style-type: none"> <li>• Django</li> <li>• Drupal</li> </ul>	<ul style="list-style-type: none"> <li>• Drupal</li> <li>• Symfony</li> </ul>

Table 4 : Specification Comparison

V. CONCLUSION

ADVANTAGES OF AMAZON EC2

- EC2 is cheaper, at least to start. One can get an EC2 Windows 2008 R2 Server instance up and running for about \$40 per month.
- EC2 is familiar. The nice thing about EC2 is it's like having your own Windows Server without buying the hardware. I can do anything I want to it; I just have to remote desktop into it.
- EC2's biggest strength: it's conceptually simple. Anyone who's ever used any VM software is going to be able to grasp what it does immediately. There's no learning curve, just instant gratification

ADVANTAGES OF MICROSOFT WINDOWS AZURE

- Azure may be cheaper than EC2 in the long run. Azure is a zero maintenance solution. You just deploy your application and Microsoft takes care of the software, patches and backups. There's a cost to maintenance which has to be taken into account when using EC2 compared to Azure. The problem is that cost is a bit hard to calculate.
- Scalability with Windows Azure is seamless. There's a good chance this application will grow to have many users and consume a massive amount of data. If it does, adding additional machines with Windows Azure is as simple as changing a value in the configuration file.

- It's completely integrated with Visual Studio. Once set up, deploying changes from Visual Studio to Windows Azure is just a couple clicks.
- Azure does more for you than EC2 does for the same price – management of the underlying OS and application server are included in addition to management of the hardware.

Many start-up companies are interested in cloud computing but they are facing a real dilemma as they hear different (positive and negative) views from different sources. This is understandable as this technology is in its infant stage. Most of the start up companies, which are in the process of making a decision to adopt some Cloud Computing technology, e.g. Microsoft Azure or Amazon EC2, find this to be a difficult decision.

Comparison given in this paper can be helpful for choosing between Amazon EC2 and Microsoft Azure cloud.

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